UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/809,318	03/24/2004	Ferencz S. Denes	032026-0772	4778

23524 7590 07/23/2008

FOLEY & LARDNER LLP
150 EAST GILMAN STREET
P.O. BOX 1497
MADISON, WI 53701-1497

EXAMINER	
JUNG, UNSU	
ART UNIT	**PAPER NUMBER**
1641	
MAIL DATE	**DELIVERY MODE**
07/23/2008	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/809,318	DENES ET AL.	
	Examiner	Art Unit	
	Unsu Jung	1641	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *29 April 2008*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-17* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-17* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *24 January 2007* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Response to Amendment

1. Applicant's amendments in the reply filed on April 29, 2008 have been acknowledged and entered. The reply did not include any claim amendments.

2. Claims 1-17 are pending and currently under consideration for patentability under 37 CFR 1.104.

Claim Rejections - 35 USC § 103

3. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

4. The factual inquiries set forth in *Graham* **v.** *John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

5. This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

6. Claims 1-8, 13, and 14 are rejected under 35 U.S.C. 103(a) as being unpatentable over Wagner et al. (U.S. PG Pub. No. US 2002/0110932, Aug. 15, 2002) in view of Hubbell et al. (U.S. PG Pub. No. US 2002/0128234, Sept. 12, 2002) and Schössler et al. (U.S. Patent No. 4,822,681, April 18, 1989).

Wagner et al. teaches methods and devices for parallel, *in vitro* screening of biomolecular activity using miniaturized microfabricated devices (see entire document). The biomolecules immobilized on the surface of the devices include proteins (Abstract) and polynucleotides (oligonucleotide, p3, paragraph [0039]). The reactive site of the device may comprise a coating between a substrate and its organic thin film. This coating can be formed on the substrate by plasma exposure, which can be used directly to activate the substrate to expose polar functionalities such as hydroxyl groups (step (a), p8, paragraph [0092]) and the substrate may be either organic or inorganic and may comprise a material selected from a group consisting of silicon silica, quartz, glass,

carbon, titanium dioxide, etc. (p6, paragraph [0075]). Deposition or formation of the coating on the substrate must occur prior to the formation of organic thin films (p8, paragraph [0097]). A variety of different organic thin films are suitable including molecules of the formula X-R-Y where R is a spacer, X is a functional group that binds R to the surface, and Y is a functional group for binding proteins onto the monolayer (p8, paragraph [0099]). X group may be chosen as any group, which affords chemisorption or physisorption of the monolayer onto the surface of the substrate (p9, paragraph [0103]). Methods for the formation of organic thin films include *in situ* growth from the surface, deposition by physisorption, spin-coating, chemisorption, self-assembly, or plasma-initiated polymerization from gas phase [p8, paragraph [0099]).

With respect to claim 2, Wagner et al. teaches a method further comprising immobilizing biomolecules on the surface by reacting the biomolecules with surface-bound spacer chains (p9, paragraph [0112]).

With respect to claim 3, Wagner et al. teaches a method, wherein the biomolecules are amine-functionalized or amine-containing biomolecules (p12, paragraph [0135]).

With respect to claim 4, Wagner et al. teaches a method, wherein the oxide surface comprises a silicon oxide (p6, paragraph [0075] and p9, paragraph [0104]).

With respect to claim 5, Wagner et al. teaches a method, wherein the oxide surface comprises silica, glass, or quartz (p6, paragraph [0075]).

With respect to claim 6, Wagner et al. teaches a method, wherein the oxide surface comprises a metal oxide (p6, paragraph [0075]).

With respect to claim 7, the current specification teaches that native oxides of stainless steel include chromium oxide and iron oxide (p18, paragraph [0060]). Wagner et al. teaches a method, wherein the metal oxide comprises chromium and iron oxides (p8, paragraph [0093]). Since Wagner et al. teaches that multiple interlayers may be used together (p4, paragraph [0057]), the substrate of Wagner combined with an interlayer of metal oxide comprising chromium oxide or iron oxide is interpreted as being the "native oxide of stainless steel" as the currently recited substrate.

With respect to claim 13, Wagner et al. teaches a method, wherein the biomolecule is oligonucleotides (p3, paragraph [0039]).

With respect to claim 14, Wagner et al. teaches a method, wherein the biomolecule is a protein (p3, paragraph [0038]).

However, Wagner et al. fails to teach a step of reacting a first gas comprising epoxy-functional molecules with the surface hydroxyl groups *in situ* in the absence of plasma to provide surface-bound spacer chains.

Hubbell et al. teaches that functional groups such as epoxy can interact with amine, hydroxyl, or thiol groups (see entire document, particularly p6, paragraph [0058]).

Schössler et al. teaches a method of reacting hydroxyl-group-containing solid body surfaces with glycidoxypropyltriethoxysilane (see entire document, particularly column 4, lines 26-29). With this variation, the biological materials to be bound react directly with the epoxy-groups of the solid body surface (column 4, lines 29-31). Herewith it is important that the reaction with the organosilanes, which are non-toxic and

are produced to a considerable extent on a large scale, be effected by simple contact or immersion, with the activation taking place in a swollen or non-swollen state of the solid body, or even in the gaseous phase (column 4, lines 31-36). It is of greater importance herewith that the reaction with organosilanes can follow in liquid phase with organic solvents, such as acetone, toluene, dioxane, methanol, ethanol, among others, solvent mixtures such as methanol/ethanol, as well as in an aqueous milieu or water/solvent mixtures, such as methanol/water or ethanol/water, so that in contrast to many other activation techniques, the technological expenditure is lower (column 4, lines 36-44). It is particularly advantageous to effect the activation in gaseous phase through employment of aerosols or by means of underpressure (column 4, lines 44-47). It is, moreover, advantageous that through the choice of different organosilanes and, if necessary, bifunctional coupling reagents, practically all imaginable reaction possibilities can be realized, since by utilization of the basic principle according to the present invention, solid body surfaces are obtained with the most various functional groups (column 4, lines 44-54).

Therefore, one of ordinary skill in the art at the time of the invention would have been motivated to include in the method of Wagner et al. with a spacer molecule X-R-Y, wherein X is an epoxy functional group as taught by Hubbell et al., in order to bind the spacer molecule the hydroxyl groups of the substrate surface of Wagner et al. with a reasonable expectation of success since Wagner et al. teaches that the X group may be chosen as any group, which affords chemisorption or physisorption of the monolayer onto the surface of the substrate. Further, one of ordinary skill in the art at the time of

the invention would have been motivated to select epoxy functional group of Schössler et al. as the Y in the spacer molecule X-R-Y of Wagner et al. since Schössler et al. teaches that biological materials including proteins can be bound to a solid body surface via reacting with epoxy functional groups on the solid surface. Moreover, it would have been obvious to one having ordinary skill in the art at the time of the invention was made to select an appropriate functional groups (X and Y) of the spacer molecule X-R-Y, since it has been held to be within the general skill of a worker in the art to select a known material on the basis of its suitability for the intended use as a matter of obvious design choice. *In re Leshin*, 125 USPQ 416. Because the claimed spacer molecule is known in the prior art and has been disclosed as being capable of reacting with a surface of a substrate and biomolecules to immobilize biomolecules to the substrate surface in general, the selection of a specific type of functional groups in the spacer molecule in itself does not present a novel feature of the claimed invention. Since one of ordinary skill in the art at the time of the invention would recognize that the spacer molecules of Wagner et al. can be have a variety of functional groups suitable to react with respective substrate surface and biomolecules, it would have been obvious to select epoxy functional group as both X and Y since Hubbell et al. teaches that epoxy functional group can interact with hydroxyl groups and Schössler et al. teaches that biological materials including proteins can be bound to a solid body surface via reacting with epoxy functional groups on the solid surface. In addition, it would have been obvious to one of ordinary skill in the art at the time of the invention to employ a method of reacting a gas comprising spacer molecules with epoxy functional groups with the

surface hydroxyl groups of Wagner et al. in view of Hubbell et al. and Schössler et al. *in situ* in the absence of plasma since Schössler et al. teaches that activation in gaseous phase through employment of aerosols or by means of underpressure provides an activation technique, which has lower expenditure compared to other activation techniques. The advantage of employing an activation technique with lower cost provides the motivation for combining the teachings of Wagner et al., Hubbell et al., and Schössler et al. with a reasonable expectation of success because Wagner et al. teaches that monolayer can be formed comprising spacer molecules in gaseous phase and the gaseous phase reaction of Schössler et al. can employ variety of different bifunctional coupling reagents (i.e. spacer molecules X-R-Y) chosen to obtain solid body surfaces with appropriate functional groups.

With respect to claim 8, Wagner et al. fails to specifically teach a method, wherein the plasma is formed from a source gas comprising water, oxygen, or a mixture thereof. Hubbell et al. teaches a method, wherein the plasma is formed from a source of gas comprising water in order to increase the number of hydroxyl groups at the oxide surface (p14, paragraph [212]), wherein the oxide surface includes stainless steel (p12, paragraph [0178]). Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to include the plasma formed on the native oxide of stainless steel from a source of gas comprising water as taught by Hubbell et al. in the method of Wagner et al. in order to form hydroxyl groups on metal oxides. The advantage of increasing the number of hydroxyl groups at the oxide surface of Wagner et al. provides the motivation to employ the method of Hubbell et al., in which plasma is

formed from a source of gas comprising water at the oxide surface of Wagner et al. with a reasonable expectation of success.

7. Claims 9 and 10 are rejected under 35 U.S.C. 103(a) as being unpatentable over Wagner et al. (U.S. PG Pub. No. US 2002/0110932, Aug. 15, 2002) in view of Hubbell et al. (U.S. PG Pub. No. US 2002/0128234, Sept. 12, 2002) and Schössler et al. (U.S. Patent No. 4,822,681, April 18, 1989) as applied to claim 1 above, and further in view of Laibinis et al. (WO 01/83826 A2, Nov. 8, 2001).

Wagner et al. in view of Hubbell et al. and Schössler et al. teaches a method of treating a surface of a substrate as set forth in item 7 above. However, Wagner et al. in view of Hubbell et al. and Schössler et al. fails to teach a method, wherein the epoxy-functional molecules are epichlorohydrin molecules.

Laibinis et al. teaches that epichlorohydrin reacts with the hydroxyl moiety of a glass (substrate surface) to provide a surface having epoxide functional groups (see entire document, particularly p19, lines 14-17).

Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to employ epichlorohydrin, which contains epoxy functional groups, as taught by Laibinis et al. in the method of Wagner et al. in view of Hubbell et al. and Schössler et al. in order to react with hydroxyl groups of oxide surface. The advantage of providing a surface having epoxy functional groups, which can be used to immobilize biological molecules, provides the motivation to combine the teachings of Laibinis et al. and Wagner et al. in view of Hubbell et al. and Schössler et al. with a reasonable

expectation of success as epoxy functional groups of epichlorohydrin can be used to react with hydroxyl groups of the oxide surface to functionalize the surface for immobilizing biomolecules. Further, it would have been obvious to one having ordinary skill in the art at the time of the invention to select an appropriate spacer molecule X-R-Y, since it has been held to be within the general skill of a worker in the art to select a known material on the basis of its suitability for the intended use as a matter of obvious design choice. *In re Leshin*, 125 USPQ 416. Because the claimed spacer molecule is known in the prior art and has been disclosed as being capable of reacting with a surface of a substrate and biomolecules to immobilize biomolecules to the substrate surface in general, the selection of a specific type of the spacer molecule in itself does not present a novel feature of the claimed invention. Since one of ordinary skill in the art at the time of the invention would recognize that the spacer molecules of Wagner et al. in view of Hubbell et al. and Schössler et al. can be variety of different molecules suitable to react with respective substrate surface and biomolecules, it would have been obvious to select epichlorohydrin of Laibinis et al. as the spacer molecule because Laibinis et al. teaches that epichlorohydrin reacts with hydroxyl moiety of a glass (substrate surface) to provide a surface having epoxide functional groups.

8. Claims 11 and 12 are rejected under 35 U.S.C. 103(a) as being unpatentable over Wagner et al. (U.S. PG Pub. No. US 2002/0110932, Aug. 15, 2002) in view of Hubbell et al. (U.S. PG Pub. No. US 2002/0128234, Sept. 12, 2002) and Schössler et

al. (U.S. Patent No. 4,822,681, April 18, 1989) as applied to claim 1 above, and further in view of Devoe et al. (WO 01/96452 A2, Dec. 20, 2001).

Wagner et al. in view of Hubbell et al. and Schössler et al. teaches a method of treating a surface of a substrate as set forth in item 7 above. However, Wagner et al. in view of Hubbell et al. and Schössler et al. fails to teach a method, wherein the epoxy-functional molecules are 1,4-butanediol diglycidyl ether molecules.

Devoe et al. teaches that numerous commercially available epoxy resins including 1,4-butanediol diglycidyl ether can be used apply on a solid surface (see entire document, particularly Abstract and p13, line 12).

Therefore, it would have been obvious matter of design choice to modify the method of Wagner et al. in view of Hubbell et al. and Schössler et al. to include 1,4-butanediol diglycidyl ether of Devoe et al. as epoxy-functional molecules, since Applicant has not disclosed that 1,4-butanediol diglycidyl ether does not solve any stated problem or is for any particular purpose and it appears that using 1,4-butanediol diglycidyl ether would provide a functionalized substrate surface for immobilization of biomolecules with a reasonable expectation of success as epoxy functional groups of 1,4-butanediol diglycidyl ether can be used to react with hydroxyl groups of the oxide surface to functionalize the surface for immobilizing biomolecules. Further, it would have been obvious to one having ordinary skill in the art at the time of the invention was made to select an appropriate spacer molecule X-R-Y, since it has been held to be within the general skill of a worker in the art to select a known material on the basis of its suitability for the intended use as a matter of obvious design choice. *In re Leshin*,

125 USPQ 416. Because the claimed spacer molecule is known in the prior art and has been disclosed as being capable of reacting with a surface of a substrate and biomolecules to immobilize biomolecules to the substrate surface in general, the selection of a specific type of the spacer molecule in itself does not present a novel feature of the claimed invention. Since one of ordinary skill in the art at the time of the invention would recognize that the spacer molecules of Wagner et al. in view of Hubbell et al. and Schössler et al. can be variety of different molecules suitable to react with respective substrate surface and biomolecules, it would have been obvious to select 1,4-butanediol diglycidyl ether of Devoe et al. as the spacer molecule since 1,4-butanediol diglycidyl ether of Devoe et al. includes epoxy functional groups that can react with hydroxyl moiety of a substrate surface.

9. Claims 15-17 are rejected under 35 U.S.C. 103(a) as being unpatentable over Wagner et al. (U.S. Patent No. PG Pub. No. US 2002/0110932, Aug. 15, 2002) in view of Hubbell et al. (U.S. PG Pub. No. US 2002/0128234, Sept. 12, 2002) and Schössler et al. (U.S. Patent No. 4,822,681, April 18, 1989) as applied to claim 1 above, and further in view of Dang et al. (U.S. PG Pub. No. 2003/0113478, Filed Dec. 12, 2001).

Wagner et al. in view of Hubbell et al. and Schössler et al. teaches a method of treating a surface of a substrate for immobilization of biomolecules as set forth in item 7 above. However, Wagner et al. in view of Hubbell et al. and Schössler et al. fails to teach a method, further comprising extending the spacer chains by reacting the spacer chains with gas-phase spacer molecules in situ in the absence of plasma to provide

extended spacer chains, wherein the spacer molecules comprise an amine group capable of reacting with epoxy functionality of the spacer chains.

Dang et al. teaches a method of forming a coating on a substrate with a surface-modifying group, which can further react with a biologically active component resulting in a substrate with an immobilized bioactive agents such as nucleic acids and proteins (see entire document, particularly p2, paragraph [0026] and p6, paragraph [0084]). Dang et al. further teaches that it may be desirable to place one or more additional compounds as a multi-functional linker between chemically functional groups and bioactive agents to increase space between the substrate layer and the bioactive agents or to reduce undesirable responses such as steric hindrances between the functional group and the immobilized bioactive/biocompatible agents, which may limit the approach of the bioactive/biocompatible agent to the functional group, and physical bulk, electrostatic repulsion, or inappropriate positioning of the bioactive/biocompatible agent or agents, which may also contribute to reduced efficiency of the immobilized bioactive/biocompatible agent or agents (p5, paragraph [0077]). Suitable compounds for use as multi-functional linkers include epoxies and amines and can be heterofunctional or homofunctional (p5, paragraph [0078]). The available functional groups or surface-modifying groups are used to covalently or non-covalently bind the bioactive agent possessing desirable properties to substrate (p5, paragraph [0080]).

Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to employ an additional spacer molecule (X-R-Y) as taught by Dang et al. in the method of Wagner et al. in view of Hubbell et al. and Schössler et al.,

in which reacting a gas comprising spacer molecules with the oxide surface in situ in the absence of plasma, in order to further coat the oxide surface to increase space between the substrate layer and the bioactive agents or to reduce undesirable responses and immobilize bioactive agents such as nucleic acids and proteins via covalently interaction with surface-modifying groups, wherein the functional group of the additional spacer molecule includes amine group as Hubbell et al. teaches that functional groups such as epoxy can interact with amine groups. The advantage of reducing undesirable responses such as steric hindrances between the functional group and the immobilized bioactive/biocompatible agents, which may limit the approach of the bioactive/biocompatible agent to the functional group, and physical bulk, electrostatic repulsion, or inappropriate positioning of the bioactive/biocompatible agent or agents, which may also contribute to reduced efficiency of the immobilized bioactive/biocompatible agent or agents, provides the motivation to combine the teachings of Dang et al. and Wagner et al. in view of Hubbell et al. and Schössler et al. with a reasonable expectation of success as one of ordinary skill in the art would recognize that additional spacer molecules would provide more efficient immobilization of biomolecules to the functionalized surface of the substrate.

Double Patenting

10. The nonstatutory double patenting rejection is based on a judicially created doctrine grounded in public policy (a policy reflected in the statute) so as to prevent the unjustified or improper timewise extension of the “right to exclude” granted by a patent and to prevent possible harassment by multiple assignees. A nonstatutory obviousness-type double patenting rejection is appropriate where the conflicting claims are not identical, but at least one examined application claim is not patentably distinct

from the reference claim(s) because the examined application claim is either anticipated by, or would have been obvious over, the reference claim(s). See, e.g., *In re Berg*, 140 F.3d 1428, 46 USPQ2d 1226 (Fed. Cir. 1998); *In re Goodman*, 11 F.3d 1046, 29 USPQ2d 2010 (Fed. Cir. 1993); *In re Longi*, 759 F.2d 887, 225 USPQ 645 (Fed. Cir. 1985); *In re Van Ornum*, 686 F.2d 937, 214 USPQ 761 (CCPA 1982); *In re Vogel*, 422 F.2d 438, 164 USPQ 619 (CCPA 1970); and *In re Thorington*, 418 F.2d 528, 163 USPQ 644 (CCPA 1969).

A timely filed terminal disclaimer in compliance with 37 CFR 1.321(c) or 1.321(d) may be used to overcome an actual or provisional rejection based on a nonstatutory double patenting ground provided the conflicting application or patent either is shown to be commonly owned with this application, or claims an invention made as a result of activities undertaken within the scope of a joint research agreement.

Effective January 1, 1994, a registered attorney or agent of record may sign a terminal disclaimer. A terminal disclaimer signed by the assignee must fully comply with 37 CFR 3.73(b).

11. Copending Application No. 11/609,045

A. Claims 1 and 4-9 are provisionally rejected on the ground of nonstatutory obviousness-type double patenting as being unpatentable over claims 19-22 of copending Application No. 11/609,045 in view of Wagner et al. (U.S. PG Pub. No. US 2002/0110932, Aug. 15, 2002) and Hubbell et al. (U.S. PG Pub. No. US 2002/0128234, Sept. 12, 2002).

The copending Application recites a method of treating a surface of a substrate, the method comprising:

- forming active sites on the substrate surface by exposing the substrate surface to a plasma; and
- reacting epoxy groups on gas-phase epoxy functional molecules with the surface active sites in situ in the absence of plasma to

provide epoxy-terminated surface bound spacer chains (linker molecules).

However, the copending Application fails to recite a method, wherein the active sites on the substrate are hydroxyl groups and the surface is an oxide surface.

Wagner et al. teaches a method, in which a coating can be formed on a substrate by plasma exposure, which can be used directly to activate the substrate to expose polar functionalities such as hydroxyl groups (step (a), p8, paragraph [0092]) and the substrate may be either organic or inorganic and may comprise a material selected from a group consisting of silicon silica, quartz, glass, carbon, titanium dioxide, etc. (p6, paragraph [0075]) as set forth in item 7 above.

Hubbell et al. teaches that functional groups such as epoxy can interact with amine, hydroxyl, or thiol groups as set forth in item 7 above.

Therefore, one of ordinary skill in the art at the time of the invention would have been motivated to employ the method of forming hydroxyl groups on an oxide substrate surface by exposing the substrate surface to a plasma as taught by Wagner et al. in the method of the copending Application with a reasonable expectation of success since Hubbell et al. teaches that epoxy functional groups interact with hydroxyl groups.

This is a provisional obviousness-type double patenting rejection.

B. Claim 10 is provisionally rejected on the ground of nonstatutory obviousness-type double patenting as being unpatentable over claims 19-22 of copending Application No. 11/609,045 in view of Wagner et al. (U.S. PG Pub. No. US 2002/0110932, Aug. 15, 2002) and Hubbell et al. (U.S. PG Pub. No. US 2002/0128234, Sept. 12, 2002) as applied to claims 1 and 9 above, and further in view of Laibinis et al. (WO 01/83826 A2, Nov. 8, 2001).

The copending Application in view of Wagner et al. and Hubbell et al. recites a method of treating a surface of a substrate as set forth in item 12A above. However, copending Application in view of Wagner et al. and Hubbell et al. fails to recite a method, wherein the epihalohydrin molecules are epichlorohydrin molecules.

Laibinis et al. teaches that epichlorohydrin reacts with hydroxyl moiety of a glass (substrate surface) to provide a surface having epoxide functional groups as set forth in item 8 above.

Therefore, one of ordinary skill in the art at the time of the invention would have been motivated to employ epichlorohydrin, which contains epoxy functional groups, as taught by Laibinis et al. in the method of the copending Application in view of Wagner et al. and Hubbell et al. with a reasonable expectation of success since Laibinis et al. teaches that epichlorohydrin reacts with hydroxyl moiety. Further, it would have been obvious to one having ordinary skill in the art at the time of the invention was made to select an epichlorohydrin as a epihalohydrin molecule, since it has been held to be within the general skill of a worker in the

art to select a known material on the basis of its suitability for the intended use as a matter of obvious design choice. *In re Leshin*, 125 USPQ 416. Because the claimed epihalohydrin molecule is known in the prior art and has been disclosed as being capable of reacting with the hydroxyl group on the substrate surface in general, the selection of a specific type of the epihalohydrin molecule in itself does not present a novel feature of the claimed invention. Since one of ordinary skill in the art at the time of the invention would recognize that the epihalohydrin molecule of the copending Application in view of Wagner et al. and Hubbell et al. can include of different halogens with epoxy functional groups, it would have been obvious to select epichlorohydrin of Laibinis et al. as the epihalohydrin molecule because Laibinis et al. teaches that epichlorohydrin reacts with hydroxyl moiety of a glass (substrate surface) to provide a surface having epoxide functional groups.

This is a provisional obviousness-type double patenting rejection.

C. Claims 11 and 12 are provisionally rejected on the ground of nonstatutory obviousness-type double patenting as being unpatentable over claims 19-22 of copending Application No. 11/609,045 in view of Wagner et al. (U.S. PG Pub. No. US 2002/0110932, Aug. 15, 2002) and Hubbell et al. (U.S. PG Pub. No. US 2002/0128234, Sept. 12, 2002) as applied to claim 1 above, and further in view of Devoe et al. (WO 01/96452 A2, Dec. 20, 2001).

The copending Application in view of Wagner et al. and Hubbell et al. recites a method of treating a surface of a substrate as set forth in item 12A above. However, copending Application in view of Wagner et al. and Hubbell et al. fails to recite a method, wherein the epoxy-functional molecules are 1,4-butanediol diglycidyl ether molecules.

Devoe et al. teaches that numerous commercially available epoxy resins including 1,4-butanediol diglycidyl ether can be used apply on a solid surface (see entire document, particularly Abstract and p13, line 12).

Therefore, it would have been obvious to one having ordinary skill in the art at the time of the invention was made to select an epoxy-functional molecule such as1,4-butanediol diglycidyl ether of Devoe et al., since it has been held to be within the general skill of a worker in the art to select a known material on the basis of its suitability for the intended use as a matter of obvious design choice. *In re Leshin*, 125 USPQ 416. Because the claimed epoxy-functional molecule, 1,4-butanediol diglycidyl ether, is known in the prior art and has been disclosed as being capable of reacting with a surface of a substrate in general, the selection of a specific type of the epoxy-functional molecule in itself does not present a novel feature of the claimed invention. Since one of ordinary skill in the art at the time of the invention would recognize that the epoxy-functional molecule of the copending Application in view of Wagner et al. and Hubbell et al. can be variety of different molecules suitable to react with the substrate surface, it would have been obvious to select 1,4-butanediol diglycidyl ether of Devoe et

al. as the spacer molecule since 1,4-butanediol diglycidyl ether of Devoe et al. includes epoxy functional groups that can react with hydroxyl moiety of a substrate surface.

This is a provisional obviousness-type double patenting rejection.

Response to Arguments

12. Rejection of claims 1-8, 13, and 14 under 35 U.S.C. 103(a) as being unpatentable over Wagner et al. in view of Hubbell et al. and Schössler et al.

Applicant's arguments filed on April 29, 2008 have been fully considered but they are not persuasive essentially for the reasons of record and arguments addressed herein.

Applicant's arguments that neither Wagner et al. nor Hubbell et al. teaches reactions between gas-phase epoxy functional molecules and surface hydroxyl groups and Schössler et al. does not teach a method of treating a surface of a substrate that includes a step of reacting epoxy groups on gas-phase epoxy-functional molecules with the surface hydroxyl groups in situ in the absence of plasma to provide epoxy-terminated surface-bound spacer chains have been fully considered and but are not found persuasive essentially for the reasons of record. As set forth in item 7 in the previous Office Action dated November 2, 2007, Wagner et al. teaches a method of obtaining a substrate surface with hydroxyl functional groups by exposing an oxide surface to plasma (p8, paragraph [0092]). Subsequently, a variety of different organic thin films including molecules of the formula X-R-Y where R is a spacer can be formed on the substrate, wherein X is a functional group that binds R to the surface and Y is a

functional group for binding proteins onto the monolayer (p8, paragraph [0099]). Although Wagner et al. teaches that X group may be chosen as any group, which affords chemisorption or physisorption of the monolayer onto the surface of the substrate (p9, paragraph [0103]), Wagner et al. is silent on specifically teaching that X group is an epoxy functional molecule that binds the spacer molecules to the surface of the substrate. Since Hubbell et al. teaches that functional groups such as epoxy can interact with amine, hydroxyl, or thiol groups (p6, paragraph [0058]), one of ordinary skill in the art at the time of the invention would have been motivated to include in the method of Wagner et al. with a spacer molecule X-R-Y, wherein X is an epoxy functional group as taught by Hubbell et al., in order to bind the spacer molecule to the hydroxyl groups on the substrate surface of Wagner et al. with a reasonable expectation of success since Wagner et al. teaches that the X group may be chosen as any group, which affords chemisorption or physisorption of the monolayer onto the surface of the substrate. Therefore, the teachings of Hubbell et al. provides the deficiency of Wagner et al. with respect to the limitation of having spacer molecules having epoxy functional groups reacting with the hydroxyl groups on the substrate surface. Further, Schössler et al. teaches that biological materials including proteins can be bound to a solid body surface via reacting with epoxy functional groups on the solid surface (column 4, lines 29-31). Therefore, one of ordinary skill in the art at the time of the invention would have been motivated to select epoxy functional group of Schössler et al. for Y in the spacer molecule X-R-Y of Wagner et al. since Schössler et al. teaches that biological materials including proteins can be bound to a solid body surface via reacting with

epoxy functional groups on the solid surface. In addition, it would have been obvious to one of ordinary skill in the art at the time of the invention to employ a method of reacting a gas comprising spacer molecules with epoxy functional groups with the surface hydroxyl groups of Wagner et al. in view of Hubbell et al. and Schössler et al. *in situ* in the absence of plasma since Schössler et al. teaches that activation in gaseous phase through employment of aerosols or by means of underpressure provides an activation technique, which has lower expenditure compared to other activation techniques. The advantage of employing an activation technique with lower cost provides the motivation for combining the teachings of Wagner et al., Hubbell et al., and Schössler et al. with a reasonable expectation of success because Wagner et al. teaches that monolayer can be formed comprising spacer molecules in gaseous phase and the gaseous phase reaction of Schössler et al. can employ bifunctional coupling reagents (i.e. spacer molecules X-R-Y) chosen to obtain solid body surfaces with appropriate functional groups. Therefore, Schössler et al. teaches that gaseous phase reaction can utilize various different types of bifunctional coupling agents (i.e. spacer molecules X-R-Y) and not limited to organosilanes as the bifunctional coupling agents.

Applicant's argument that the epoxy functionalities are not reacted with the hydroxyl groups on the polymer surfaces in the gas phase reactions of Schössler et al. has been fully considered but is not found persuasive essentially for the reasons of record. As stated above, one of ordinary skill in the art at the time of the invention would have been motivated to include in the method of Wagner et al. with a spacer molecule X-R-Y, wherein X is an epoxy functional group as taught by Hubbell et al., in

order to bind the spacer molecule to the hydroxyl groups on the substrate surface of Wagner et al. with a reasonable expectation of success since Wagner et al. teaches that the X group may be chosen as any group, which affords chemisorption or physisorption of the monolayer onto the surface of the substrate and Hubbell et al. teaches that functional groups such as epoxy can interact with amine, hydroxyl, or thiol groups (p6, paragraph [0058]). Further, one of ordinary skill in the art at the time of the invention would have been motivated to select epoxy functional group of Schössler et al. for Y in the spacer molecule X-R-Y of Wagner et al. since Schössler et al. teaches that biological materials including proteins can be bound to a solid body surface via reacting with epoxy functional groups on the solid surface. In addition, Wagner et al. teaches that variety of coating methods known in the art can be employed for coating organic thin films (X-R-Y) including *in situ* growth from the surface, deposition by physisorption, spin-coating, chemisorption, self-assembly, or plasma-initiated polymerization from gas phase [p8, paragraph [0099]). Although, Wagner et al. and Hubbell et al. teach that organic thin films (epoxy-functional molecules) can be grown *in situ*, they are silent on disclosing a coating method by reacting gas-phase organic thin films (epoxy-functional molecules) with the surface hydroxyl groups *in situ* in the absence of plasma. Schössler et al. teaches that activation in gaseous phase through employment of aerosols or by means of underpressure provides an activation technique, which has lower expenditure compared to other activation techniques (column 4, lines 36-44). It is, moreover, advantageous that through the choice of different organosilanes and, if necessary, bifunctional coupling reagents, practically all

imaginable reaction possibilities can be realized, since by utilization of the basic principle according to the present invention, solid body surfaces are obtained with the most various functional groups (column 4, lines 44-54). Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to employ a method of reacting a gas comprising spacer molecules with epoxy functional groups (organic thin films) with the surface hydroxyl groups of Wagner et al. in view of Hubbell et al. and Schössler et al. *in situ* in the absence of plasma since Schössler et al. teaches that activation in gaseous phase through employment of aerosols or by means of underpressure provides an activation technique, which has lower expenditure compared to other activation techniques. The advantage of employing an activation technique with lower cost provides the motivation for combining the teachings of Wagner et al., Hubbell et al., and Schössler et al. with a reasonable expectation of success because Wagner et al. teaches that monolayer can be formed comprising spacer molecules in gaseous phase and the gaseous phase reaction of Schössler et al. can employ a variety of different bifunctional coupling reagents (i.e. spacer molecules X-R-Y) chosen to obtain solid body surfaces with appropriate functional groups. Taken together, the combined teachings of Wagner et al. in view of Hubbell et al. and Schössler et al. meets the limitation of "reacting epoxy groups on gas-phase epoxy-functional molecules with the surface hydroxyl groups *in situ* in the absence of plasma to provide epoxy-terminated surface bound spacer chains" currently recited in independent claim 1 and all dependent claims.

Applicant’s argument that the solution-phase-reaction mechanism for reactions between epoxy and hydroxyl groups taught in each of the prior art references could not work in the gas phase has been fully considered, but is not found persuasive essentially for the reasons of record. As set forth in item 7 in the previous Office Action dated November 2, 2007, Hubbell et al. teaches that functional groups such as epoxy can interact with amine, hydroxyl, or thiol groups (see entire document, particularly p6, paragraph [0058]). Hubbell et al. further teaches that functionalization process can be performed in gaseous or liquid state (p10, paragraph [0138]). In response to applicant's argument that the references fail to show certain features of applicant’s invention, it is noted that the features upon which applicant relies (i.e., reaction between epoxide group of epichlorohydrin and hydroxyl groups) are not recited in the rejected claim(s). Claims 9 and 10 are directed to epihalohydrins and epichlorohydrin, respectively, and claims 9 and 10 are rejected under 35 U.S.C. 103(a) as being unpatentable over Wagner et al. in view of Hubbell et al. and Schössler et al., and further in view of Laibinis et al. Therefore, the arguments with respect to the reaction between epoxide group of epichlorohydrin and hydroxyl groups are addressed below section of “Rejection of claims 9 and 10 are rejected under 35 U.S.C. 103(a) as being unpatentable over Wagner et al. in view of Hubbell et al. and Schössler et al., and further in view of Laibinis et al. “

In view of the foregoing response to argument, the rejection of claims 1-8, 13, and 14 under 35 U.S.C. 103(a) as being unpatentable over Wagner et al. in view of Hubbell et al. and Schössler et al. has been maintained.

13. <u>Rejection of claims 9 and 10 under 35 U.S.C. 103(a) as being unpatentable over Wagner et al. in view of Hubbell et al. and Schössler et al., and further in view of Laibinis et al.</u>

Applicant's arguments filed on April 29, 2008 have been fully considered but they are not persuasive essentially for the reasons of record and arguments addressed above and herein.

Applicant's argument that the reaction of epichlorohydrin and hydroxyl groups Applicant’s argument that Laibinis et al. fails to teach a method of reacting gas-phase epichlorohydrin molecules and hydroxyl groups on oxide surfaces has been fully considered but is not found persuasive for the reasons set forth below. Applicant's argument involves reaction of epoxide group with hydroxyl group by opening a ring-opening step using acidic reagent, a metal catalyst, a basic reagent, and/or solvating water molecule step. However, this argument is found irrelevant because the method of Laibinis et al. does not involve reaction between epoxide group of epichlorohydrin with hydroxyl group since Laibinis et al. teaches that epichlorohydrin reacts with hydroxyl moiety of a glass (substrate surface) to provide a surface having epoxide functional groups (see entire document, particularly p19, lines 14-17). In addition, it is well known in the art that the epichlorohydrin molecules can interact with hydroxyl groups in gas-phase as evidenced by Material Safety Data Sheet for epichlorohydrin (see p6, *Ecological Information* section of MSDS Number: E0925, Jan. 1, 1996, Mallinckrodt Baker, Inc., Phillipsburg, NJ, pp1-9).

In view of the foregoing response to argument, the rejection of claims 9 and 10 under 35 U.S.C. 103(a) as being unpatentable over Wagner et al. in view of Hubbell et al. and Schössler et al., and further in view of Laibinis et al. has been maintained.

14. Rejection of claims 11 and 12 under 35 U.S.C. 103(a) as being unpatentable over Wagner et al. in view of Hubbell et al. and Schössler et al., and further in view of Devoe et al.

Applicant's arguments filed on April 29, 2008 have been fully considered but they are not persuasive essentially for the reasons of record and arguments addressed above and herein.

Applicant's argument that Devoe et al. does not teach a method of reacting gas-phase 1,4-butanediol diglycidyl ether molecules and hydroxyl groups on oxide surfaces is acknowledged. As stated above, Schössler et al. teaches the method of reacting gas-phase bifunctional coupling agents and surface bound hydroxyl groups and it would have been obvious to one having ordinary skill in the art at the time of the invention was made to select an appropriate spacer molecule X-R-Y, since it has been held to be within the general skill of a worker in the art to select a known material on the basis of its suitability for the intended use as a matter of obvious design choice. *In re Leshin*, 125 USPQ 416. Because the claimed spacer molecule is known in the prior art and has been disclosed as being capable of reacting with a surface of a substrate and biomolecules to immobilize biomolecules to the substrate surface in general, the selection of a specific type of the spacer molecule in itself does not present a novel feature of the claimed invention. Since one of ordinary skill in the art at the time of the

invention would recognize that the spacer molecules of Wagner et al. in view of Hubbell et al. and Schössler et al. can be variety of different molecules suitable to react with respective substrate surface and biomolecules, it would have been obvious to select 1,4-butanediol diglycidyl ether of Devoe et al. as the spacer molecule since 1,4-butanediol diglycidyl ether of Devoe et al. includes epoxy functional groups that can react with hydroxyl moiety of a substrate surface.

Regarding Applicant's argument with respect to lack of gas-phase reaction of epoxy-functional molecules with hydroxyl groups, the response to argument set forth above addresses the limitation of "reacting epoxy groups on gas-phase epoxy-functional molecules with the surface hydroxyl groups *in situ* in the absence of plasma to provide epoxy-terminated surface bound spacer chains" currently recited in independent claim 1 and all dependent claims.

In view of the foregoing response to argument, the rejection of claims 11 and 12 under 35 U.S.C. 103(a) as being unpatentable over Wagner et al. in view of Hubbell et al. and Schössler et al., and further in view of Devoe et al. has been maintained.

15. Rejection of claims 15-17 under 35 U.S.C. 103(a) as being unpatentable over Wagner et al. in view of Hubbell et al. and Schössler et al., and further in view of Dang et al.

Applicant's arguments filed on April 29, 2008 have been fully considered but they are not persuasive essentially for the reasons of record and arguments addressed above and herein.

In view of the foregoing response to argument, the rejection of claims 15-17 under 35 U.S.C. 103(a) as being unpatentable over Wagner et al. in view of Hubbell et al. and Schössler et al., and further in view of Dang et al. has been maintained.

16. Provisional Double Patenting Rejections

Applicant's request to withdraw all provisional double patenting obviousness-type rejection in the reply filed on April 29, 2008 has been acknowledged but not granted as all the prior art rejections set forth in the previous Office Action dated November 2, 2007 have been maintained.

In view of the foregoing response to argument, all the provisional double patenting rejections set forth in the previous Office Action dated November 2, 2007 have been maintained.

17. Since the prior art fulfills all the limitations currently recited in the claims, the invention as currently recited would read upon the prior art.

Conclusion

18. No claim is allowed.

19. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

20. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Unsu Jung whose telephone number is (571)272-8506. The examiner can normally be reached on M-F: 9-5.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Long Le can be reached on 571-272-0823. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Unsu Jung/
Unsu Jung, Ph.D.
Patent Examiner
Art Unit 1641